

## Abstract

The purpose of this research effort was to conduct ambient monitoring of CO and SO<sub>2</sub> at the Bodega Bay Marine Lab on the Northern California coast (55 miles north-northwest of San Francisco) to estimate regional ship emissions from this currently unregulated source of air pollutants. Despite extensive efforts to procure and operate a trace-level SO<sub>2</sub> monitor sufficient for the research objectives, the SO<sub>2</sub> instrument purchased failed to perform to the necessary specifications and consequently did not allow us to make useful ambient measurements of SO<sub>2</sub> along the coast. Because the instrument did not perform according to its advertised specifications, it was returned to the manufacturer who provided a complete refund. Unfortunately, the SO<sub>2</sub> measurement problems did not become fully evident until after concerted and considerable personnel efforts had been expended in laboratory calibrations, field deployment, data analysis, and protracted troubleshooting attempts that ultimately failed. These difficulties depleted much of the resources of the contract and prevented several project tasks from being fully accomplished. Moreover, the failure to measure simultaneous increases in CO and SO<sub>2</sub> concentrations prevented us from identifying the type of engines responsible for the CO spikes, and thus made it impossible to make any inferences about offshore NO<sub>x</sub> emissions.

Despite the problems with the faulty SO<sub>2</sub> instrument, we were able to make new measurements of CO and ozone at Bodega Bay which may help to provide baseline air quality data for the offshore environment. Continued detailed analysis of the shoreline pollutant data and the collocated meteorological data have allowed further improvement of the estimation of offshore CO emissions and boundary layer heights. Additional efforts were made to deploy the CO instrument on a Cessna 210 airborne platform in support of a regional greenhouse gas emissions experiment, with the hope that some flights could be performed over the ocean to investigate CO vertical gradients, and thereby help to infer regional offshore emissions. Continuing along those lines, effort was also invested in the analysis of existing datasets of airborne data collected offshore of Northern California (e.g. INTEX-B, DYCOMS-II, ITCT, and ARCTAS-CA.) Approximately consistent results were obtained of  $\sim 200 \mu\text{mol m}^{-2}\text{d}^{-1}$  of CO being emitted from the offshore region writ large.

Additionally, a preliminary survey of the local fishing community at Bodega harbor was conducted to ascertain offshore ship traffic frequency, and to develop an inventory of engine types at the local marina. Because of the absence of SO<sub>2</sub> data and the efforts it consumed, the determination of the engine make-up of the local fleet was unsuccessful. However, support of these overall efforts have paved the way for future SO<sub>2</sub> monitoring with improved instrumentation (GC/MS), and integration with the CO and meteorological measurements at the site.